

SPECIFICATION

Title of the Invention:

Evacuatable Valve, Evacuatable Bag, and Production Process Thereof

Technical Field:

The present invention relates to an evacuatable valve which may open and close an air-through portion by a specific arrangement of a valve body, and an evacuatable bag provided with the evacuatable valve.

Background of the Invention:

As disclosed by Laid-Open Japan Utility Model Application H05-44837, there have been evacuatable bags which may make goods such as clothing, bedding, etc. that are usually fluffy with air in small volume by removing the air inside the bag.

An opening portion for inserting the goods formed on the disclosed evacuatable bag may be hermetically closed. In addition, many kinds of an evacuatable bag have an evacuatable valve disposed with an air-through portion for letting the air inside the bag out.

A vacuum can be connected with the evacuatable valve of the bag when sucking the air in the bag out.

One of the evacuatable valves used in the bag for containing bedding etc. is adduced by the above-mentioned Japanese application. This type of the valve is formed integral with the evacuatable bag, comprising a base body allowing communication between the inside and outside of the bag through an air-through portion, and a covering which fits on the base body by screwing together.

The base body is formed with a valve body, which may open and close the air-through portion formed on the covering when the covering is screwed off the base body.

Specifically, the evacuatable valve is arranged such that the valve body is left biased by energizing means such as a spring to close the air-through portion, and as aforementioned, only when the vacuum is connected with the bag, the air-through

portion is opened to let the internal air out of the bag.

And finally, by screwing the covering onto the base body, the valve body is kept closed to ensure that the evacuable bag will maintain the evacuated state.

For the purpose of preventing any leak of air within the evacuable bag, the conventional evacuable valve needs a separate member such as a covering for closing the air-through portion. And, since the base body and the covering projecting from the evacuable bag, it may cause trouble in piling the evacuable bags. Furthermore, in the production process, it may become a problem to store the evacuable valves alone.

In view of the above-described problems, the present invention provides an evacuable valve that needs no separate member such as a covering for closing an air-through portion and has only a small portion that projects therefrom.

The present invention also provides an evacuable valve which does not bulk and easily store in the production process of the evacuable bag.

Summary of the Invention:

To overcome said problems, a first aspect of the present invention provides an evacuable valve comprising a body member 2 provided with an air-through portion 33 passing from its front face to its back face, and a valve body 5 disposed so as to open and close the air-through portion 33. The body member 2 includes a valve seat portion 32 for mounting the valve body 5. The valve seat portion 32 has a valve body contacting area 32a which slants toward the front face as running from the central part thereof to the periphery. The air-through portion 33 is arranged to radiate in the valve seat portion 32 with a view from above. The valve body 5 is securely fixed to the central part 32b of the valve seat portion 32 and is movable close to or away from the valve body contacting area 32a by floating out except for the fixed portion. While the valve body 5 contacts the valve body contacting area 32a, the air-through portion 33 is closed.

In a second aspect of the present invention, the evacuable valve of the first embodiment includes a depressed area 7 on the front face thereof. The valve seat portion 32 of one

evacuatable valve 1 can at lease partly rest in the depressed area 7 of the other valve 1. The evacuatable valves can be piled up by putting the front face of one evacuatable valve 1 and the back face of the other evacuatable valve 1 together.

In a third aspect of the present invention, an evacuatable bag made of flexible resin film is provided with the evacuatable valve 1 of the first or second embodiments. The evacuatable valve 1 is mounted in order for the bag to communicate between the outside and inside of the bag through the air-through portion 33 formed on the valve seat portion 32 of the evacuatable valves 1. Thus, the bag may be evacuated and keep the evacuated state.

A fourth aspect of the present invention provides a production process of the evacuatable bag. The process comprises steps of opening a valve mounting hole 83 in the flexible resin film 81; taking one from the piled evacuatable valves 1 in accordance with any one of the first and second embodiments; positioning the evacuatable valve 1 to coincide with the valve mounting hole 83; and bonding the evacuatable valve 1 to the film 81.

In the first aspect of the present invention, the valve body 5 can securely contact the slanted valve body contacting area 32a, thereby enabling the air-through portion 33 to be securely closed to ensure the evacuated state. Furthermore, there is no need of providing a separate member such as a covering for closing the air-through portion.

In the second aspect of the present invention, the valve seat portion 32 of one evacuatable valve can at least partly rest in the depressed area 7 of the other evacuatable valve, thereby being able to pile up the evacuatable valves. Besides, piling and storage of the evacuatable valves 1 do not need excessive space and much effort even in the production process of the evacuatable bags 8.

In the third aspect of the present invention, the evacuatable bag 8 which may keep the evacuated state thereinside for a long period of time without provision of a separate member such as a covering for closing the air-through portion is provided.

In the fourth aspect of the present invention, a production process of the evacuatable bags 8 that can keep the evacuated state

for a long period of time is provided.

Brief Description of the Drawings:

The present invention will become more fully understood from the detailed description given hereinbelow and the accompanying drawings, which are given by way of illustration only, and thus are not limitative of the present invention, and wherein:

FIG. 1(A) is a plan view illustrating an evacuable valve of the embodiment of the present invention, and FIG. 2(B) is a bottom view illustrating the same,

FIG. 2 is a cross sectional view taken along a line I - I,

FIG. 3(A) is a cross sectional diagram showing the structures of the sections of the evacuable valve of the embodiment of the present invention, and FIG. 3(B) is a plan view of the valve body,

FIG. 4 is a plan view showing an evacuable bag equipped with the evacuable valve of the embodiment,

FIG. 5 is a cross sectional diagram showing the piled evacuable bags,

FIG. 6(A) is a diagram showing the ridges of the evacuable valve functioning as spacer, and FIG. 6(B) is a diagram showing a direction in which air is flowing, and

FIG. 7 is a diagram showing an example of the production system for evacuable bags of the embodiment, and FIG. 7(B) is a diagram showing the relationship between the bag sheet and the evacuable bag during production.

Detailed Description of the Invention:

In the following description, as regards a body member 2, the side (as shown in FIG. 1(A)) where a valve body 5 is provided shall be referred as "front face", while the other side thereof (in FIG. 1(B)) as "back face", and any reference to the directions of the front and back will be made based on the above-described sides.

In this embodiment, an evacuable valve 1, which is made of synthetic resin, is composed of a body member 2, a valve body 5 and a valve body covering 6.

The body member 2 is a plate-like member in appearance,

wherein air is allowed to pass through air-through portion 33 between the front and back faces.

This particular body member 2 comprises a valve portion 3 formed with an air-through portion 33 and a base portion 4 formed around the valve portion 3 for the purpose of attachment to the evacuable bag 8.

In this embodiment, the valve portion 3 includes a wall 31 and a valve seat portion 32 positioned in a direction of the back face of the wall 31.

The wall 31 looks like a ring in a plan view and a wall in a cross sectional view, as shown in FIG. 2, projecting from the base portion 4 in both directions of the front and back faces.

Though the wall 31 is shown to be perpendicular to the base portion 4 here, it does not limit to this and may be formed at an angle to said base portion 4.

On the inner surface of the wall 31 is provided with fitting projection 32e for fitting and securing the valve body covering 6 (see FIG. 3(A)).

The valve seat portion 32, being made planar, shares a back face end 31b of the wall 31 and resembles a bowl with the bottom constituting a center portion 32b, as viewed from the front face. In this embodiment, the center portion 32b is flat, while a valve body contacting area 32a encompassing the center portion has a tapering slanted surface. The valve seat portion 32 may be entirely consisted of curved surface like a dish antenna.

The valve body contacting area 32a is a portion formed on said tapering slanted surface on the front face of the valve seat portion 32. By way of contact of the film valve body 5 to the valve body contacting area 32a, the air-through portion 33 formed in a position where the valve body 5 covers in a plan view may be closed.

In this embodiment, a valve body fixing projection 32c is provided in the center portion 32b, projecting therefrom. As shown in FIG. 3(B), the valve body 5 may be mounted on the valve seat portion 32 by fitting the projection into a mounting hole 51a formed in the valve body 5.

With the evacuable valve 1 of this embodiment, as shown in FIG. 5, the evacuable valves can be piled up by putting the back

face end 31b (a peripheral portion of the valve seat portion) of an evacuable valve 1 on the front face end 31a of the wall 31 in the piled evacuable valve 1.

As discussed later, in consequence that a valve body 5 and a valve body covering 6 are mounted on the valve portion 3, a depressed area 7 includes said wall 31 and the valve body covering 6. Part of the valve seat portion 32 and valve portion ridges 32d formed on the back face of the valve seat portion 32 will rest in the depressed area 7. This enables the evacuable valves 1 to pile up neatly, and in the production process of evacuable bags, as illustrated by FIG. 7(A), the production system 100 can subsequently operate in a relatively compact space thanks to the piled valves.

The air-through portion 33 is formed in the valve seat portion 32 so as to communicate from the front face to the back face. As seen in FIG. 1(B), the air-through portion 33 radiates from the center of the valve seat portion in a plan view. In this embodiment, the air-through portion 33 where to be covered by the valve body 5 is divided in four directions at right angles to the respective adjacent ones.

Reinforcing pieces 33a, 33b are provided at the air-through portion 33 to extend in radial and circumferential directions respectively. The air-through portion 33 is set off by the reinforcing pieces 33a, 33b so as to be spaced 90 degrees apart in four directions in a plan view. The reinforcing pieces 33a, 33b on the front face are flush with the valve body contacting area 32a, constituting the same surface. Such an arrangement of the reinforcing pieces 33a, 33b setting off the valve body 5 prevents the valve body 5 from bending and being sucked into the air-through portion 33 under the influence of atmospheric pressure when the valve body 5 has closed the air-through portion 33, whereby air leakage through a clearance which may be formed between the valve body 5 and the valve body contacting area 32a will not occur, thus resulting in the air-through portion 33 being securely closed.

Of both reinforcing pieces 33a, 33b, the reinforcing pieces 33a, which have been formed to extend in a radial direction, also may serve as a valve portion ridge 32d, as described later.

The form of the air-through portion 33 in a plan view does not limit to the abovementioned, but may employ various shapes such as a slit or a round hole. And the reinforcing pieces are also made changeable, for example, in the form of a mesh.

As aforementioned, forming the valve seat portion 32 aslope and the air-through portion 33 radial in a plan view enable air to flow smoothly from the back face to the front face in the evacuable valve 1 through the air-through portion 33. That is, as shown in FIG. 4, if the evacuable valve 1 of the present embodiment is mounted on the evacuable bag 8, an air stream F along the base portion 4 inside the bag will flow toward the air-through portion 33 by virtue of the slope on the back face of the valve seat portion 32 and valve portion ridges 32d so that quick evacuation can be achieved (see FIG. 6(B)).

As shown in FIGS. 3(A) and 3(B), the valve body 5 is a piece of film. In accordance with the present embodiment, slits 52, which are cut off from the outer periphery in the radial direction, divide a round of the valve body in a plan view into four equal parts, thereby bearing four valve blades 53 to be formed around a central portion 51 in a cloverleaf pattern, as viewed from above.

The central portion 51 in the valve body 5 fits to the valve seat portion 32, being provided with a cross-shaped mounting hole 51a in this embodiment. The valve seat portion 32 and the valve body 5 are joined together by fitting the valve body fixing projection 32c being crossed-shaped in a plan view and provided on the central portion 32b of the valve seat portion 32 to the mounting hole 51a. Thus, the central portion 51 of the valve body 5 has been securely fixed in position, wherein the valve blades 53 may move close to or away from the valve body contacting area 32a by means of its floating motion.

The valve body 5 is in a flat form to be able to cover the air-through portion 33 which is formed radial on the valve seat portion 32. In addition, the valve body 5 may contact the valve body contacting area 32a on the surface of the valve seat portion 32. The abovementioned arrangement makes it possible to allow the valve body 5 to close the air-through portion 33.

To cope with what has been described above, the valve body

5 will be made to match the air-through portion 33 in shape. Therefore, according to the shape of the air-through portion 33, the number of the valve blades 53 may be determined, e.g. two, three, or more than five. Moreover, each of the valve blades 53 may be respectively made independent rather than share the central portion 51.

Also, with reference to the attachment of the valve body 5 to the valve seat portion 32, adhesives, thermal bonding, screws or rivets may be employed in addition to fitting of the valve body mounting hole 51a and the valve body fixing projection 32c of the valve seat portion 32. As regards the position where to fix the valve body 5, outer peripheries, side ends, or other areas than the central portion 51 of the valve body 5 may be available to match the shape of the valve body 5.

As foregoing, the valve body 5 is a film type, and it is preferable that it be flexible in nature and excellent in resiliency of the form. To be more specific, relatively flexible resin film or paper impregnated with resin may be used. The back face of the valve body 5, where the valve body contacting area 32a contacts, may be coated with adherent materials to improve adhesion to the valve body contacting area 32a in closing the air-through portion 33.

Owing to the valve body 5 as disclosed above, the air-through portion 33 in evacuation is opened only by the air flowing from the back face to the front face, and except for that, the valve body 5 sticks to the valve body contacting area 32a so as to keep the air-through portion 33 closed. This may avoid unexpected opening of the air-through portion 33 except for evacuation, even if no separate covering of screw fitting in the prior art is provided, and the evacuable bag 8 provided with the evacuable valve 1 may hold its airtightness for a long period of time.

For the purpose of reassuring users of the bag, as shown in FIG. 3(A), a cap 9 fit to the wall 31 of the body member 2 may be provided by way of covering of the valve portion 3 in the evacuable valve 1 of this embodiment is.

As above mentioned, the valve body covering 6 together with the valve body 5 is mounted to the valve body fixing projection

32c formed on the valve seat portion 32. Shown in FIGS. 1(A) and 3(A), the valve body covering 6 shapes like a disk in a plan view and has a round air hole 61 formed in the center thereof. Provided in the back face of the valve body covering 6 is a valve body press foot 62 in a manner of heading from four directions to the center. As shown in FIG. 3(A), said valve body press foot 62 is triangular in a cross sectional shape while the shape in the back face is linear to match the slope of the valve body contacting area 32a.

Such being the case, when the valve body covering 6 is attached to the valve portion 3, a predetermined clearance will be constituted between the valve body contacting area 32a and the valve body press foot 62. As shown in FIG. 2, the valve body 5 is to be disposed in this clearance.

When the valve body covering 6 is attached to the valve portion 3, the valve body press foot 62 embraces the central area of valve blades 53 of the valve body 5, being disposed from the central portion 51 to circumferential directions. In this case where the valve blades 53 are formed to extend in four different directions, the valve body press foot 62 are formed to extend in the four directions responding to the blades. Thus, the valve body press foot 62 will be formed to cope with the shape of the valve body 5 when the valve body 5 is different from the shape in the present embodiment.

The positions of the clearance and the valve body 5 are determined to prevent excessive floating of the valve body 5, as is explained later.

So, even if there still exists a clearance between the valve body contacting area 32a and the valve body press foot 62, where the valve body 5 disposed in the position can float, it is acceptable. Or the valve body 5 may be tightly sandwiched between the valve body contacting area 32a and the valve body press foot 62, meaning no clearance exists therebetween.

Referring to the abovementioned respect, it is most preferable that as in the latter case, the valve body 5 bear a contact relationship between the valve body contacting area 32a and the valve body press foot 62.

Here, the larger the air-through portion 33, the more

smoothly evacuation is achieved, but that would entail enlargement of the valve body 5 and the valve blades 53 of the valve body 5 will be liable to float, thereby increasing the risk of air leakage.

Thus, the relationship between the valve body contacting area 32a and the valve body press foot 62 sandwiching the valve body 5 therebetween may let the valve body press foot 62 function to separate the valve blades 53, thereby ensuring reduction of the risk of air leakage due to floating of the valve body 5.

In the center of the air hole 61 of the valve body covering 6 is provided a cylindrical mounting portion 63, which is fully supported by the valve body press foots 62 and fits to the valve body fixing projection 32c as formed in the valve seat portion 32. By this means, the central portion 51 of the valve body 5 will be sandwiched between the central portion 32b of the valve seat portion 32 and said mounting portion 63 before the valve body 5 stays fixed.

The outer periphery of the valve body covering 6 fits to fitting projection 32e formed on the inner surface of the wall 31 (see FIG. 3(A)). The valve body covering 6 may be firmly stuck on the valve body portion 3 accordingly.

Owing to the valve body covering 6 thus mounted to the valve portion 3, even when air passes through the air-through portion 33, the valve body 5, floating of which is limited by the valve body press foot 62, will not flip over and may securely close the air-through portion 33.

The base portion 4 is a flat portion as formed around the valve portion 3 and substantially rectangular in a plan view, as shown by FIGS. 1(A) and 1(B).

The front face of the base portion 4 consists of a flat smooth surface, where a bag film 81 is attached by any bonding means such as thermal bonding. On the back face thereof is formed with base portion ridges 41. In this embodiment shown in FIG. 1(B), they are arranged parallel at a predetermined interval to the longer side of the base portion 4.

When an evacuable bag 8 has been completed as shown in FIG. 4, the base portion ridges 41 serve as a spacer for bearing a clearance between the bag film 81 of the evacuable valve 1 side

and the film 81 of the other side (see FIG. 6(A)), and also function to guide the internal air toward the air-through portion 33 of the evacuable valve 1 (see FIG. 6(B)), thereby ensuring discharge of the internal air of the evacuable bag 8.

If said function of the base portion ridges 41 matters, it is preferable that the base portion 4 be provided as in the case of the present embodiment, but if not, an evacuable valve 1 consisting only of a valve portion 3 may be directly mounted to the evacuable bag 8 without provision of a base portion 4.

Referring to the shape of the base portion 4, it is not limited rectangular, and a variety of shapes such as circular or oval one may be available.

As well as the back face of the base portion 4 where the base portion ridges 41 are formed parallel to the long side thereof, the valve portion 3 is also provided with radial valve portion ridges 32d on the back face of the valve seat portion 32, as shown in FIG. 1(B).

FIG. 6(B) shows that the air inside the evacuable bag 8 provided with an evacuable valve 1 is guided to the valve seat portion 32 by the base portion ridges 41, and consequently to the air-through portion 33 by the valve portion ridges 32d. Thus, the air inside the evacuable bag 8 is easily guided to the air-through portion 33.

FIG. 6(A) shows that the ridges 41, 32d function as a spacer so that the constituent clearance between the bag film 81 of the valve 1 side and the bag film 81 of the other side can be maintained without their contacting. This arrangement may avoid any interruption caused by tight contact of the bag films in emission of the air, resulting in complete evacuation.

The evacuable valve 1 of the present embodiment having the structure as mentioned above is mounted on the evacuable bag 8 for actual use, as shown in FIG. 4.

A bag to be used as evacuable bag 8 is made of a bag film 81 of flexible resin and the like, having a closing means 82a such as a zipper, provided at the opening portion 82 in order to keep the bag airtight. The production method for the evacuable bag 8 is described later.

General use of this particular evacuable bag 8 is as follows.

First, a hose or nozzle of the vacuum is connected to the valve body covering 6 of the evacuable valve 1. Then, the vacuum turns on so as to detach the valve body 5 from the valve body contacting area 32a, whereby the air-through portion 33 and the air hole 61 of the valve body covering 6 are opened to emit the air inside the bag through said elements. After the emission of the air is finished and the hose or nozzle the vacuum is disconnected from the evacuable valve 1, the valve body 5 contact the valve body contacting area 32a again, resulting in closing the air-through portion 33. In this occasion, since the valve body 5 strongly sticks to the valve body contacting area 32a under atmospheric pressure, unexpected opening of the air-through portion 33 will not occur, which ensures that the evacuated condition inside the bag will be maintained for a long period of time.

Now, the description will be made of a production process of the evacuable bag 8 of this embodiment.

Flexible resin film of polyethylene or the like is used as a material for the bag. In this embodiment, a sheet of bag film 81 wound in a roll is fed in a longitudinal direction thereof to be processed.

As shown in FIG. 7(B), a mounting hole 83, where an evacuable valve 1 is to be mounted, is formed in the bag film 81. The hole is slightly bigger than the valve portion 3, more specifically, than the outer diameter of the wall 31 in a plan view.

A production system 100, shown in FIG. 7(A), for performing said production process includes a server 102, where evacuable valves 1 pile up in the fashion shown in FIG. 5 next to the film 81. Each valve here is ready-assembled with a body member 2, a valve body 5, and a valve covering 6. A lowest one of the piled valves 1 is taken out to slide toward the direction of lying over the bag film 81 in order for the valve portion 3 of the evacuable valve 1 to coincide with said mounting hole 83 of the bag film. In this case, though not shown, an actuator traveling along a slide track 101 which is discussed later moves the evacuable valve 1. Then, the film 81 and the base portion 4 of the valve 1 are securely fixed by thermal bonding.

After that, the film 81 provided with the evacuable valve

1 and the film 81 of the opposite side are bonded to make a bag. Concurrently, a fastener 82a for closing the opening portion 82 is provided to complete an evacuable bag 8.

The above-described steps are as one example, so they may be changed in sequence or be increased by an additional step.

As discussed already, the base portion ridges 41 are formed on the back face of the base portion 4 of the evacuable valve 1 in a direction of the longer side. Concerning the production system 100 of this embodiment, a linear slide track 101 is provided at right angle to the direction of the longer side of the film 81. Not shown in detail, this slide track 101 consists of more than a couple of parallel rails 101a which are laid hanging in midair or fixed onto a flat plate. The rails 101a maintain an interval therebetween to correspond with the intervals between the base portion ridges 41 when an evacuable valve 1 is placed on the slide track 101. As a slide track 101 in this embodiment, two rails 101a, 101a are disposed and have an interval to correspond with the interval L between the outmost ridges 42 of the base portion 4 as shown in FIG. 1(B).

The evacuable valve 1 placed on the rails 101a of the slide track 101 may slide on the slide track 101. Thus, the base portion ridges 41 function as a guide for the valve in sliding on the track so that the production process can be carried out efficiently.

In the first aspect of the present invention, a valve body can securely contact a slanted valve body contacting area, thereby enabling an air-through portion to be securely closed to ensure the evacuated state. Furthermore, there is no need of providing a separate member such as a covering for closing the air-through portion.

In the second aspect of the present invention, the valve seat portion of one evacuable valve can at least partly rest in the depressed area of the other evacuable valve, thereby being able to pile up the evacuable valves. Besides, piling and storage of the evacuable valves do not need excessive space and much effort even in the production process of evacuable bags.

In the third aspect of the present invention, the evacuable

bag may keep the evacuated state thereinside for a long period of time without provision of a separate member such as a covering for closing the air-through portion.

In the fourth aspect of the present invention, a production process of the evacuable bag that may keep the evacuated state for a long period of time is provided.